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### Feature Article - Leading Indicators of Employment

#### INTRODUCTION

Employment is an important factor in determining macroeconomic policy settings. Understanding the pace and direction of changes in employment is of great interest to researchers, policy makers and the wider community.

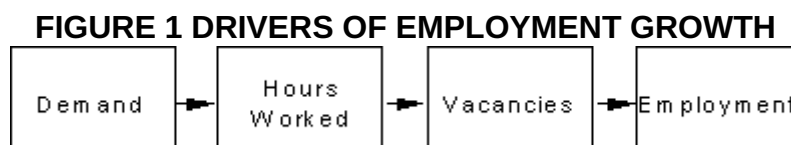
The Australian Bureau of Statistics (ABS) publishes a number of different indicators that encapsulate information on the condition of the labour market. These indicators include employment, unemployment, labour force participation, hours worked and job vacancies.

This article focuses on employment and uses three potential leading indicators. The series used as potential leading indicators are total actual hours worked, job vacancies and Gross Domestic Product (GDP).

There are other series which could be used as leading indicators of employment. These include the ANZ Bank newspaper job advertisements and the Department of Employment and Workplace Relations Leading Indicator of Employment. However, only ABS data has been used in this article.

In March 2004, 9.5 million people were employed in Australia. Of these, 6.8 million were employed full-time (working 35 hours or more) and 2.7 million were employed part-time (working less than 35 hours). (Labour Force, Australia cat. no. 6202.0).

Figure 1 describes a simple example of how an upturn in demand for goods and services may lead to an increase in employment by a firm.



When a firm faces increased demand for its product, it may initially increase the hours worked by its employees to service this additional demand. That is, the existing workers are asked to work longer hours.

If the firm believes that the increase in demand is long lasting, it may advertise for additional workers to sustain the increased level of output. These vacancies may eventually be filled and total employment will increase.

Of course the link between each step is not guaranteed. An increase in demand may result in a firm running down inventories rather than increasing production. Alternatively, increased demand may be met by an increase in the productivity of existing workers rather than an increase in the

number of hours worked or the number of workers.

## **METHODS: TURNING POINT AND CORRELATION ANALYSIS**

Turning point analysis is used to compare the patterns of peaks and troughs in three series- actual hours worked, job vacancies, and GDP-to see which series is the best leading indicator of employment. The lag time between a movement in one series leading a movement in employment is also examined.

Turning point analysis involves capturing the business cycle component from each series. This is done by separating the business cycle component from the other time series components, such as the irregular and long-term trend components and comparing the respective peaks and troughs over time.

Broadly, this is done by applying different length Henderson moving averages to remove short cycles of less than two years (which produces a trend series) and very long cycles of more than eight years (which produces a long-term trend series). The difference between the trend and the long-term trend is referred to as the business cycle component of the time series. The business cycle component in this article is presented as standard deviations from the long-term trend. A full business cycle represents the movement from peak- trough-peak or from trough-peak-trough.

Correlation analysis is a technique which can be used to measure the degree of linear association between two variables. The stronger the linear correlation (i.e. closer to +1 or -1), the closer the association between the two variables. By examining the correlation between the business cycle component of each series, the strength of the relationship can be assessed. The analysis can also examine whether there is correlation with future (or previous) periods. This is often referred to as lead-lag analysis.

## **DATA**

The monthly employment data are from **Labour Force, Australia** (cat. no. 6202). The monthly hours worked data are from **Labour Force, Australia, Detailed-Electronic Delivery** (cat. no. 6291.0.55.001).

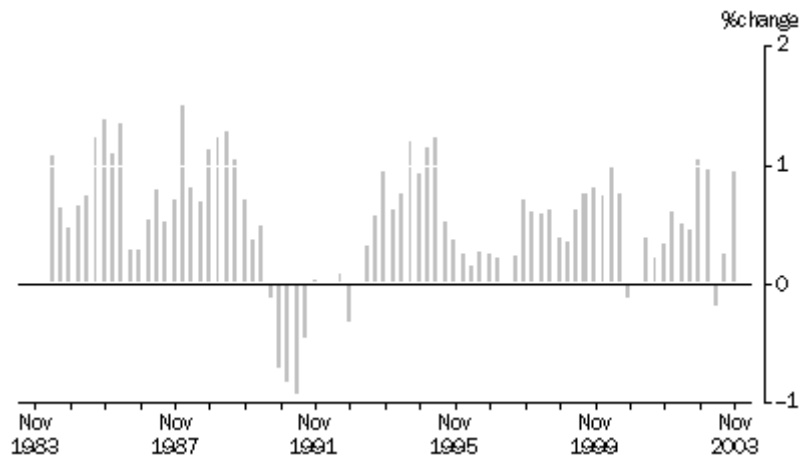
The quarterly job vacancies series is from **Job Vacancies, Australia** (cat. no. 6354.0). Quarterly GDP is from **Australian National Accounts: National Income, Expenditure and Product** (cat. no. 5206.0).

## **EMPLOYMENT GROWTH**

It is useful to observe employment growth between periods. This makes it easier to observe occasions when employment falls during economic downturns and increases during expansions.

Figure 2 shows quarterly percentage changes in the level of employment (trend series) from March 1984 to December 2003.

FIGURE 2: QUARTERLY CHANGES IN EMPLOYMENT, TREND



Employment increased steadily during the mid to late 1980s. During 1989 employment growth began to slow, ending with the recession of the early 1990s. In 1992 employment growth began to recover. Since this time employment growth has been reasonably steady. However, employment did fall for a brief period in 2000 and 2003.

The next section of this article explores the relationship between the three potential leading indicators and employment. All series referred to in the analysis are the business cycle component of the seasonally adjusted series.

## EMPLOYMENT AND HOURS WORKED

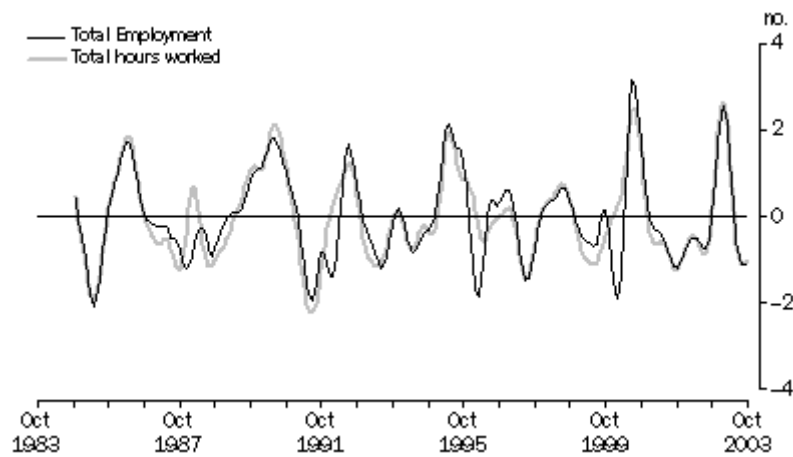
A firm facing increased demand for its product may increase the hours worked by its employees to meet the additional demand. Existing workers are only willing (or able) to work a certain amount of additional hours. If demand continues to increase additional workers may have to be employed. Therefore, a rise in the number of hours worked may be a leading indicator of employment.

Turning point and correlation analysis was conducted for total employment and the total number of actual hours worked. Figure 3 shows the turning point analysis for the business cycle component of total employment and total hours worked.

This provides a visual representation of the turning points for each series. For example, when the business cycle component of employment dips below zero, employment is below the long-term trend. Conversely when the business cycle component of employment is above zero, employment is above the long-term trend.

The total actual hours worked series looks broadly similar to the total employment series over the period November 1983 to October 2003. It is of interest to note that the troughs experienced by total employment in March 1996 and February 2000 were not closely matched by the total hours worked.

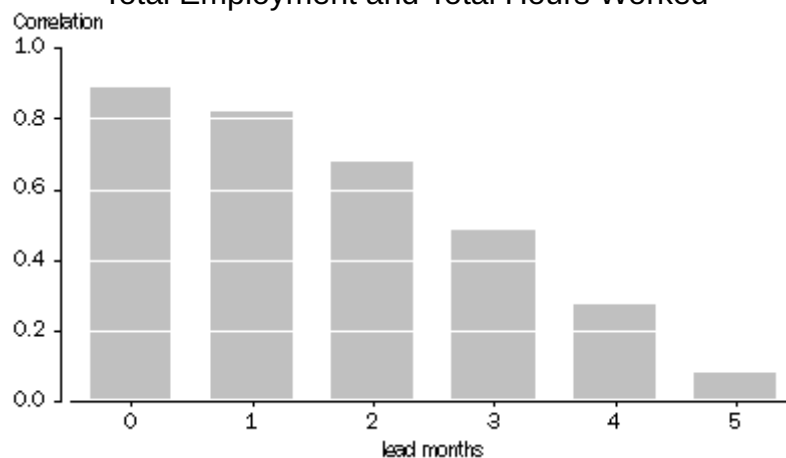
FIGURE 3: BUSINESS CYCLE TURNING POINT ANALYSIS,  
Total Employment and Total Hours Worked



Peaks in total actual hours worked lead peaks in employment by up to one month. However, in most cases peaks in total actual hours worked coincide with peaks in employment. Troughs in total actual hours worked lead troughs in employment by up to two months over the period.

The relationship between total actual hours worked and total employment can be difficult to disentangle. A rise in the total number of actual hours worked could be a function of existing employees working longer hours or new employees contributing to the total actual hours worked. This is evident from examining the correlation analysis for the two variables in Figure 4. This tests the strength of the relationship between hours worked in one month and employment in the subsequent five months.

FIGURE 4: BUSINESS CYCLE CORRELATION COEFFICIENT  
Total Employment and Total Hours Worked



The estimated correlation coefficients show that the strongest relationship (0.89) was found for total employment and total actual hours worked in the same month (i.e. month 0). There was also a very high correlation coefficient (0.82) between total hours worked and employment one month later.

From the turning point and correlation analysis it is clear that total actual hours worked and total employment move very closely together.

Occasionally, total actual hours worked does lead total employment. In particular it does appear to be more effective in leading troughs than peaks in total employment.

## EMPLOYMENT AND JOB VACANCIES

If a firm believes that the increase in demand for its product is long lasting, it might commence recruitment activities for additional workers to sustain the increased level of output. These vacancies may eventually be filled and total employment will increase.

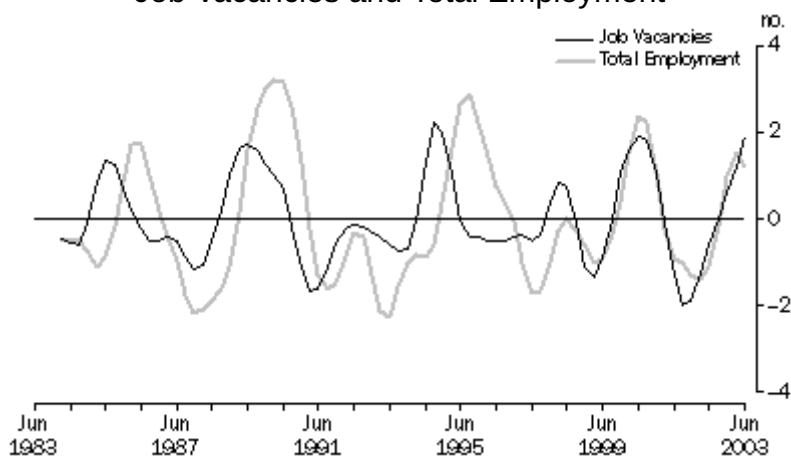
The quarterly Job Vacancies Survey is conducted in February, May, August and November each year. The quarterly estimates of employment are based on monthly Labour Force Survey results for those same months.

Figure 5 illustrates the business cycle components of the job vacancies and total employment series. There are four main cycles for both job vacancies and total employment over the period from February 1984 to May 2003.

Peaks in job vacancies lead peaks in total employment by up to four quarters over the period. Troughs in job vacancies lead troughs in total employment by up to three quarters over the period. Interestingly, from November 1999 onwards both series moved more closely together, covering about two full cycles.

This may indicate that since November 1999 the period of time between a vacancy appearing and being filled has shortened. The exact cause behind this change is not clear. One possible explanation is that there has been an overall improvement in matching job vacancies and job seekers.

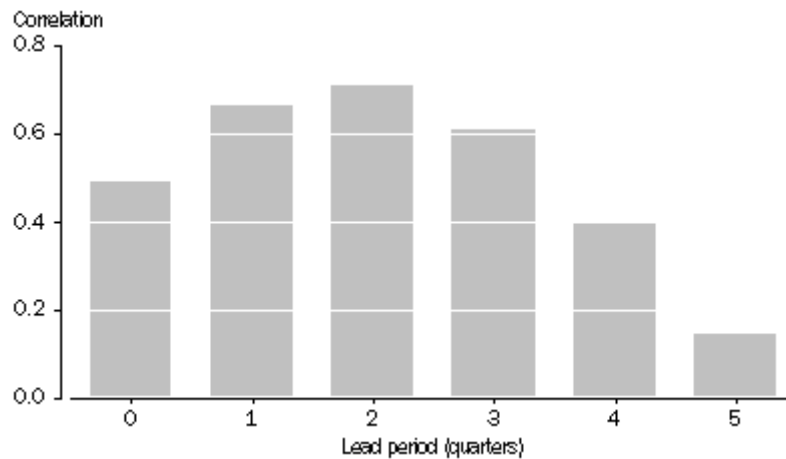
FIGURE 5: BUSINESS CYCLE TURNING POINT ANALYSIS  
Job Vacancies and Total Employment



Results from the correlation analysis show that there is a positive linear association between the business cycles of the job vacancies and total employment series over the period. Figure 6 shows that the strongest correlation coefficient (0.69) was found between the job vacancies series in one quarter and the total employment series two quarters later. That is, over the period, job vacancies were most likely to lead total employment by two quarters.

The next strongest correlation coefficient (0.66) over the period was job vacancies leading total employment by one quarter.

FIGURE 6: BUSINESS CYCLE CORRELATION COEFFICIENT  
Job Vacancies and Total Employment



Sensitivity analysis was conducted using the first and last months labour force data to represent the quarter (i.e. using January or March data instead of February to represent the first quarter of the year). The results from using the first and last month were very similar to using the middle month and did not change any of the conclusions.

For a more detailed analysis of the relationship between job vacancies and employment growth please refer to “Do Job Vacancies Provide A Leading Indicator of Employment Growth?” in the May 2003 edition of **Australian Economic Indicators** (cat. no. 1350.0).

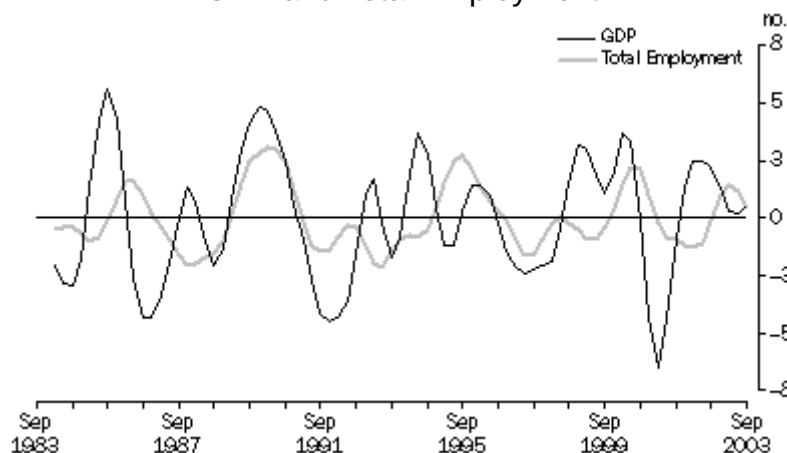
## EMPLOYMENT AND GDP

Increased GDP may lead to increased demand for a firm’s product. If the firm believes that the change in demand is long lasting it may eventually increase employment. That said, an increase in GDP may also result in a firm running down inventories rather than increasing production. The increased demand may also be met by increased productivity of existing workers rather than increased employment.

In the following analysis the estimates of employment are based on the middle month of the quarter.

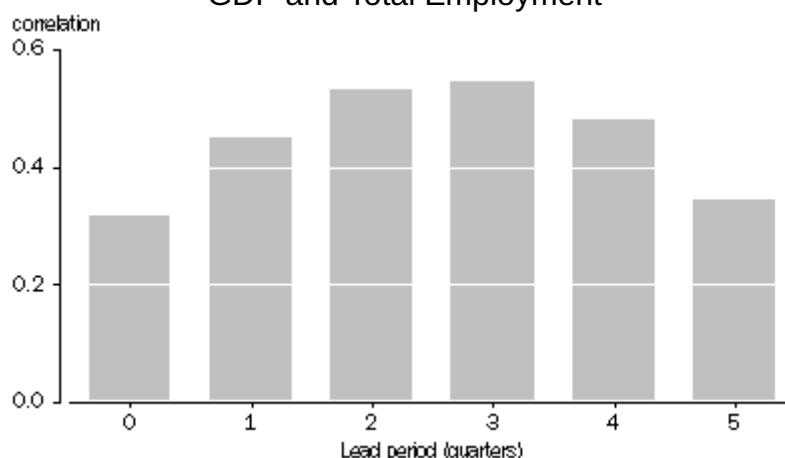
As shown in Figure 7, GDP and employment each experienced four full cycles between December 1983 and September 2003. Peaks in GDP tends to lead total employment by up to five quarters over the period. Troughs in GDP lead troughs in total employment by up to four quarters. In the June quarter 1997 GDP and employment simultaneously experienced a trough.

FIGURE 7: BUSINESS CYCLE TURNING POINT ANALYSIS  
GDP and Total Employment



The strength of the relationship between GDP in one quarter and total employment in the subsequent five quarters is shown in Figure 8. The strongest correlation coefficient (0.55) was found between the GDP series and the employment series three quarters later. That is, over the period, GDP was most likely to lead total employment by three quarters. The next strongest correlation coefficient (0.53) was for GDP leading employment by two quarters.

FIGURE 8: BUSINESS CYCLE CORRELATION COEFFICIENT  
GDP and Total Employment



## FULL-TIME EMPLOYMENT AND GDP

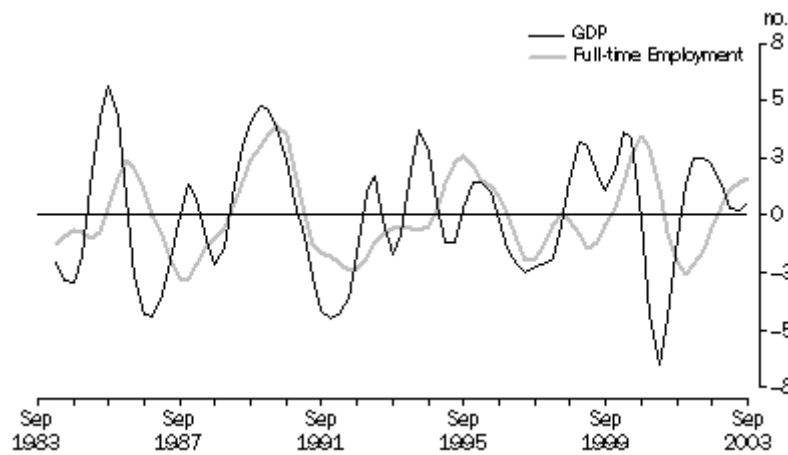
The total employment series includes people employed on a full-time and part-time basis. An increase in GDP may in fact reduce the level of part-time employment. As demand increases, workers may move from part-time employment into full-time employment. Conversely, a fall in demand may increase part-time employment as full-time workers have their hours reduced. It may also be the case that the increase in GDP will not affect part-time employment.

However, understanding the exact dynamics at work is very difficult. For this analysis we decided to only consider the relationship between GDP and full-time employment.

Figure 9 shows the turning point analysis for GDP and full-time employment. Full-time employment looks very similar to the total employment series over the period December 1983 to September 2003 with four main cycles. This is not surprising given that full-time employment accounts for the majority (72%) of total employment.

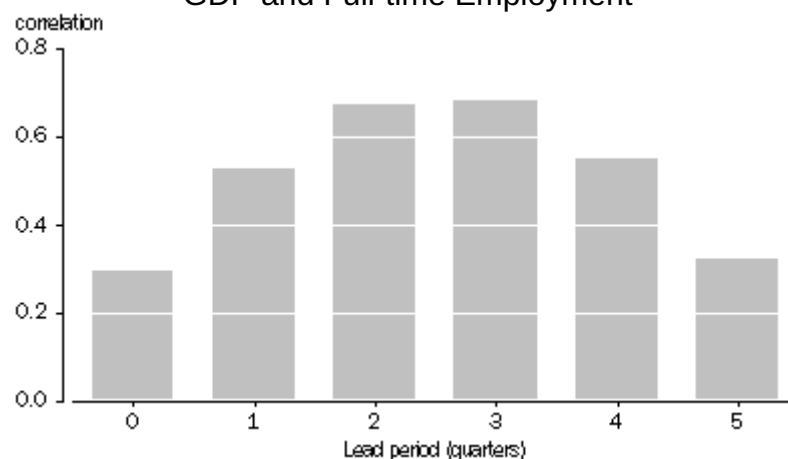
Peaks in GDP tend to lead peaks in full-time employment by up to five quarters. The lead period for troughs is one quarter shorter with GDP leading by up to four quarters. The trough in GDP in March 2001 was followed by a trough in full-time employment three quarters later.

FIGURE 9: BUSINESS CYCLE TURNING POINT ANALYSIS  
GDP and Full-time Employment



The estimated correlation coefficients show that the strongest relationship (0.68) existed for GDP and full-time employment three quarters later (Figure 10). This is stronger than the highest correlation coefficient found for GDP and total employment.

FIGURE 10: BUSINESS CYCLE CORRELATION COEFFICIENT  
GDP and Full-time Employment



As the relationship between GDP and full-time employment appears to be stronger than GDP and total employment, one would expect that GDP and part-time employment may have a weaker relationship. This is indeed the case. The relationship between GDP and part-time employment is extremely weak. The correlation coefficient (not included in this article) did not exceed 0.22 for any lead period between GDP and part-time employment.

## CONCLUSION

Turning point and correlation analysis have shown that three series, total actual hours worked, job vacancies and GDP, could be used as leading indicators for employment.

Total actual hours worked appears to have a strong relationship with employment. Occasionally total actual hours worked seems to be a reasonable short term leading indicator of total employment. Total actual hours worked does appear to be more effective in leading troughs than peaks in total employment.

For longer leading periods, GDP was a reasonably good leading indicator for employment. The strongest lead between GDP and employment was at three quarters. The relationship is much stronger if one uses full-time rather than part-time or total employment.



Job vacancies was found to be the best leading indicator for employment over the period. The strongest relationship was between job vacancies and employment two quarters later.

## **FURTHER INFORMATION**

For more information about leading indicators of employment please contact Mr Terry Rawnsley on Canberra (02) 6252 6307 or email <[terry.rawnsley@abs.gov.au](mailto:terry.rawnsley@abs.gov.au)>

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